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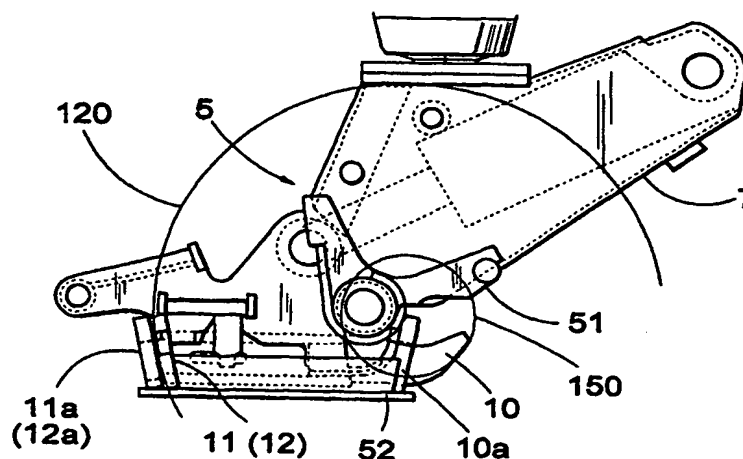
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(54) Title: TOOL ARRANGEMENT



(57) Abstract

A tool coupling (5) consists of a first part (51) belonging to a tool holder, and a second part (52) belonging to a tool, said parts being adapted to be easily made to co-operatively connect to each other, and easily be disconnected from each other. There are means (11) adapted to bring the parts (51, 52) in one interlocked position and in one unlocked position. The first part (51) is provided with at least one projection (10) and the second part is provided with at least one recess (10a). When the projection (10) and the hole (10a) are in a fully co-operative position where the parts are in a position suitable for interlocking, said means can be activated. Said first part (51) is provided with at least two projections (10, 11) extending in opposite directions. Said second part (52) is provided with at least two oppositely located holes (11a, 12a), each related to an end wall of said second part (52). At least one projection (11) is adapted to be said means for in a first position of the projection (11) interlocking the parts (51, 52) for rigid co-operation with each other and in a second position of the projection (11) unlock and disconnect the parts (51, 52) so that they can be separated.

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Tool Arrangement

Field of application

The present invention refers generally to a tool coupling, and more specifically to such a tool coupling comprising a first part belonging to a tool holder
5 and a second part belonging to a tool.

The parts mentioned are adapted for being easily connected to each other and easily disconnected from each other.

The invention also describes means, which can with a displacement
10 mechanism or similar force the parts into a locking position or a released position.

More specifically, the present invention describes that the first part should be provided with at least one projection and the second part be provided with at least one recess.

The projection and the recess should be in a co-operating position when
15 the parts are in a locking position.

Technical state of the art

Tool couplings of the type mentioned in the introduction are earlier known in many embodiments. It is thus known that a first part of the tool coupling can be
20 attached to the front part of a lifting means of a power unit, and a second part of the tool coupling can be attached to a tool as a part belonging to the tool.

In a position when the two parts are co-operating, they are rigidly connected to each other by means of a locking arrangement, to enable the lifting means to elevate or lower the tool by means of a piston-cylinder device, and to
25 lean or tilt 30 the tool by means of another piston-cylinder device.

It is also previously known to apply to the free end of one arm of an excavator a link device and a rotator, to achieve high freedom of manoeuvre for a tool, usually a bucket, a gripper or similar.

It is also known to mount crane means to trucks, and to equip its outer
30 end with a tool holder. Such trucks are known as crane trucks.

For rapidly coupling means or tool couplings, such as for attaching a tool to a tool holder for purposes mentioned above, it is earlier known to utilise a part

attached to the tool and a locking unit powered by hand or by hydraulic force.

From the Swedish published patent application 454 192 a rapid coupling for excavator tools is previously known, from the Swedish published patent application 457 651 a coupling for releasable connecting of a tool and the manoeuvring arm of an excavator are previously known and from the Swedish published patent application 458 534 an arrangement of a rapid coupling for releasable connecting of a tool and the manoeuvring arm of an excavator are also known, all showing different designs in the technical field of the present invention.

(The Swedish patent application 9804280-7 shows and describes a tool holder for crane trucks, where it is also described a multitude of applications of the tool holder as well as different tools. The application mentioned should be regarded as incorporated in the present application).

Description of the present invention

Technical problems

In view of the fact, that the technical considerations of a professional within the relevant field must perform to be able to offer a solution to one or more technical problems comprise initially an insight into the actions or the sequence of actions needed, as well as the means available, the following technical problems should be regarded as relevant for motivating the present invention.

In view of the technical state of the art as described above, one technical problem with a tool coupling as stated above must be to create such conditions that a first part belonging to a tool holder and a second part belonging to a tool can be made to co-operate with each other in a simple way, when the first part is attached to the free end of a manoeuvrable arm of a crane in a lifting machine arrangement.

In addition to this it is a technical problem to create such conditions that the co-operation mentioned can be realised even when the part belonging to the tool holder is suspended from the crane arm by a universal joint or/and the tool is resting obliquely on its support.

It is a technical problem to realise the need and the advantage of suggesting a tool coupling, where the first part mentioned is provided with at least two

oppositely pointing projections, and the second part mentioned is provided with at least two holes, and the projections and the holes are designed for mutual co-operation.

5 It is also a technical problem to be able to suggest a design where the two projections mentioned are designed to co-operate with the two holes mentioned with close tolerances, and that at least one projection should be adapted to be the means mentioned, to lock the parts relative to each other with the projection extended, and to release the parts when the projection is withdrawn.

10 There is also a technical problem in realising the need and the advantage of creating a possibility to make a first projection as a rigid projection while a second projection is a displaceable projection, where the direction of displacement correlates to or is parallel to a centre line related to the rigid projection.

15 There is also a technical problem in realising the need and the advantage of having three projections, one of which is rigidly arranged, while two projections are displaceable and adjacent to each other.

There is also a technical problem to realise the importance and advantages of letting the rigid projection be located between the extensions of the centre-lines of the two displaceable projections and of letting the displaceable projections be located in the same plane as the rigid projection.

20 There is also a technical problem to realise the importance and advantages of letting a V-shaped gullet or similar in the second part be adapted to guide the entry of the first part into the second part while the rigid projection is in exclusive interconnection with a hole in the part belonging to the tool, until in an interconnecting position the two displaceable projections can be moved towards corresponding holes in the second part.

25 There is also a technical problem to realise the importance and advantages of letting the first part be provided with a plug designed to guidingly co-operate with the V-shaped gullet when the first part is moving toward the second part mentioned.

30 It may especially be regarded as a technical problem to realised the importance and the advantages of making the rigid projection slightly curved, basically claw-shaped.

It is also a technical problem to realise the importance and the advantages of making the claw-shaped projection start with a straight outward pointing portion, then diverge with a downward slope and finally diverge with an upward slope, and at least at its free end portion be tapering upwards.

5 The invention also comprises a unitary second part belonging to the tool, well designed to be used together with a tool coupling with a first part belonging to a tool holder of the kind described in the introductory portion.

For this part belonging to the tool, there is a technical problem to express the conditions for having a base plate or similar, attachable to the tool, and two
10 end walls extending from the plate, at least one of said end walls should be tilted, and if both are tilted, they should be diverging from the base plate, and one of those end walls should have a hole symmetrically located with respect to said plate.

There is also a technical problem of realising the importance and the ad-
15 vantages of making each of said end walls with an angle of divergence between 5 and 15-degrees, preferably about 10 degrees.

There is also a technical problem of realising the importance and the advantages of providing two sidewalls located between said end walls, preferably parallel to each other.

20 There is also a technical problem of realising the importance and the advantages of making said holes in said end walls circular with the centre line of each hole at right angles to the plane of the end wall.

There is a special technical problem of realising the importance and the advantages of using an upper edge of one of the end walls as a supporting sur-
25 face, and letting the first part belonging to the holder rest against said supporting surface while the second part is moved in a arcular path and the rigid projection enters the hole in the end wall.

There is also a technical problem of realising the importance of having a hole adapted to the rigid projection through the end wall facing said projection,
30 and made with close enough tolerance to locate the first part belonging to the holder.

It is also a technical problem to choose such designs where the side walls extend upward past the end walls to form supporting surfaces above and outside the end walls to co-operate with supporting surfaces on the first part.

5 Solution

In order to solve one or more of the technical problems listed, the present invention presumes a tool holder with properties mentioned above, where according to the invention said first part shall be provided with at least two projections extending in opposite directions, and said second part is provided with at least two holes located in relation to said second part, said projections being adapted for co-operation with said holes, and at least one projection doing this by locking the parts against each other when in a first extended position, and disengaging the parts in a second retracted position.

As preferred embodiments within the frame of the invention, it is suggested that a first projection is rigidly located in relation to the first part while the second is slidably located in a direction coinciding with or parallel to the centre line of the projection.

It is further described that among three projections one projection should be rigidly arranged, and that the two slidable projections should be arranged to co-operate with one hole each in the same end wall.

It is further described that the rigid projection is located between the extended centre lines of the two slidable or movable projections.

According to the invention it is further described to provide a V-shaped gullet or similar in the second part, where the gullet is utilised for guiding the first part until one or two projections are brought into alignment with corresponding holes in the second part.

It is further described that the first part is provided with a plug shaped for co-operation with the V-shaped gullet.

The present invention specifically suggests an embodiment where the single rigid projection should be claw-shaped and be in part diverging downward, in part diverging upward, and tapering at least in the upward direction.

The invention also comprises a part belonging to the tool, consisting of a unit, which is easily applicable to any chosen tool.

Here is described a plate or similar, with two end walls, said end walls diverging from the plate, and in one end wall a hole symmetrically with respect to
5 the plate.

It is further described that the angle of divergence of each end wall is between 5 and 15 degrees, preferably around 10 degrees.

Between the end walls there are provided sidewalls, preferably parallelly oriented.

10 It is described that said holes in said end walls should be circular with the centre line of the hole oriented at right angle to the plane of the end wall.

It is especially described that the upper edge of one of the end walls should serve as a supporting surface during an arcuate motion of the first part.

An opposite end wall is then adapted to receive the first part with close
15 tolerance.

It is further described that the sidewalls should be adapted to extend past an end wall to provide a pair of support surfaces for the first part.

Additionally, it is described that the side walls between the end walls should form parallel supporting surfaces for the first part, and that said support
20 surfaces then are arranged to extend upward and be located above the end walls and beyond an end wall.

Advantages

The main advantages which may be regarded as characteristic of a tool
25 coupling according to the present invention, are that conditions have been created for simply connecting a first part belonging to the tool holder and a second part belonging to the tool, even when the first part is supported without angular restriction such as by a universal joint or gimbals.

It has further been described means for simple guiding of the first part
30 through an arcuate motion to a co-operating position in relation to the second part.

The means to bring the parts to an interlocked position comprises at least one slidingly movable projection belonging to the first part.

The invention further describes a second part belonging to the tool, which in a simple way can be applied to any tool, and which irrespective of where it has been applied to the tool offers a simple method to bring the first part belonging to the holder into a co-operating position relative to the second part, and to lock the parts relative to each other once they have reached such a co-operating position.

What can be regarded as characteristics for a tool coupling according to the present invention is stated below in the characterizing part of claim 1, and what can be regarded as characteristics of the tool coupling part belonging to the tool is stated below in the characterizing part of claim 10.

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Brief description of the figures

Some embodiments of tool couplings which can at present be regarded as relevant, with the significant characteristics of the present invention, as well as their application to pallet handling, will now be described with reference to the drawings, where:

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- Figure 1 shows a side view of a pallet handling operation, when a loaded pallet is in a suspended position, hanging freely without angular restriction in a tool coupling as described by the invention,
- Figure 2 shows the pallet supported on a floor with the pallet forks partly withdrawn from the pallet,
- Figure 3 shows a side view of a first part belonging to the tool holder, specifically the part attached to a crane arm of a machine to hold the tool,
- Figure 4 shows a sectioned side view of a second part, belonging to the tool, of a first embodiment of a tool coupling,
- Figure 5 shows a first sectioned end view of the second part according to figure 4,
- Figure 6 shows a horizontal view of the second part according to figure 4,
- Figure 7 shows a second sectioned end view of the second part according to figure 4,
- Figure 8 shows a sectioned side view of a second part, belonging to the tool, of a second embodiment differing from figures 4-7 but shown in figures 1 and 2,

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- Figure 9 shows a first sectioned side view of the second part according to figure 8,
- Figure 10 shows a horizontal view of the second part according to figure 8,
- Figure 11 shows a second sectioned end view of the second part according to figure 10,
- Figure 12 shows an initial position when a first part is going to be moved towards co-operating with a second part,
- Figure 13 shows the two parts in a slightly advanced position,
- Figure 14 shows the two parts in a final co-operating position, and
- Figure 15 shows a partial enlarged view of the position according to figure 12, where the first part is about to start a partly arcuate rotatory motion around a centre of rotation defined by a supporting surface or edge at an end wall belonging to the second part.

15 Description of here suggested embodiments

Figure 1 thus shows a side view of an equipment for lifting pallets, where a crane arrangement 4 of a crane vehicle not shown at its free end 4a is provided with a tool coupling according to the invention.

The tool coupling 5 is here shown as connected to link means 53, a rotator and a holder as previously mentioned in the Swedish patent application referred to above.

The tool coupling 5 proposed by the invention consists of a first part 51 belonging to the tool holder, and a second part 52 belonging to the tool, where figure 1 shows the parts 51, 52 in a position where they are co-operating and interlocked.

Figure 1 thus shows that the second part 52 is connected by a bolt connection 54 to a pallet fork 2, the fork points 2a of which are used to carry a pallet 3 with a load 3a.

It follows that a centre of gravity T_p will be located by a vertical line 6 straight below a joint 4b employed to connect the link means to the crane arm 4.

A piston and cylinder 7 with related parts is installed for tilting and moving the pallet fork 2.

Referring to figure 2 it is obvious how the centre of gravity T_p will be located by a vertical line 6' right below the angularly mobile joint 4b when the pallet 3 which with its load 3a is resting on a floor G.

The enlarged details in figure 2 will be explained later.

5 Referring to figure 3, this shows in a lateral view the first part 51 belonging to the holder. Figure 4 shows a sectioned lateral view of the second part 52 belonging to the tool, and attached in a known way to a tool such as the frame 2b of a pallet fork.

The parts mentioned 51, 52 are adapted to be easily moved into a co-operating position through angular motions, and easily be disengaged from each other, with appropriate means for defining one fully co-operating lockable position and one fully disengaged position.

Said first part 51 is provided with at least one projection 10

Said second part 52 is provided with at least one hole 10a.

15 When the projection 10 and the hole 10a are in a co-operating position, the parts can be locked relative to each other by locking means, here shown as a slidable projection 11.

Said first part 51 is adapted to have at least two projections 10, 11 extending away from each other.

20 Said second part 52 is provided with at least two holes 10a, 11a adapted to fit the projections and related to said part.

The holes 10a and 11a are consequently related to said part 52.

The projections 10, 11 are adapted for co-operation with said holes, and at least one of these projections is adapted to be said locking means, with a possibility to lock the parts to each other when it is in an extended position, and to leave the parts free to move relative to each other when it is in a retracted position shown in figure 3.

In figure 3 it is shown that one projection 10 is rigid while the other is slidable in a direction related to the centre line 11' of the projection 11.

30 In one embodiment of the second part according to figures 4 - 7 it is shown, especially in figure 6, that the total number of projections can be chosen to three, where two of those are made slidable or otherwise movable, and that the

latter projections 11, 12 are employed for co-operating with holes in one single end wall.

The two slidable projections 11, 12 located one on each side of the centre line of the rigid projection 10 or its extension. The slidable projections 11, 12 are located in the same plane as the rigid projection 10.

10 A V-shaped gullet 45 or corresponding in the second part 52 is adapted to guide the first part 51 until one or two slidable projections are aligned with corresponding holes 11a, 12a of the second part.

The first part is provided with a plug 45a shaped for co-operation with the V-shaped gullet 45.

The rigid projection 10 is claw-shaped since it is first diverging obliquely downwards, then diverging obliquely upwards, and in any case tapering forward-upwards.

The reason for making the projection 10 tapering is to make it easier to connect with the hole 10a in the end wall 42.

Relative to a centre line 10' for the basis of the projection 10, the first centre line 10a of the claw-shaped portion should form an angle d of up to 20 degrees, preferably around 10 degrees.

A second centre line 10b should form an angle e of between 10 and 60 degrees, preferably between 30 and 50 degrees, or around 40 degrees, relative to the first centre line 10a.

The portion of the claw-shaped part which covers the first centre line 10a should have a length slightly less than its diameter, such as 60-90 % less than said diameter.

The portion of the claw-shaped part which covers the second centre line 10b should have a slightly shorter length, and be outwardly tapering.

An upper surface 10c could be oriented parallel to the second centre line 10b but should rather form an angle f less than 40 degrees, preferably between 10 and 30 degrees, such as around 20 degrees.

A lower surface 10d could be oriented parallel to the second centre line 10b but should rather form an angle g less than 60 degrees, preferably between 10 and 30 degrees, such as around 20 degrees.

From this follows that the claw-shaped part or projection is outwardly-upwardly tapering with a cone angle of taper equal to the sum of cone angles f and g in the vertical plane shown in figure 3.

In a horizontal plane an angle twice the cone angle can be selected to the
5 angle value equal to $-f + -g$ or somewhat less.

The second part 52 belonging to the tool consists according to figure 4 of a base plate 40, from which base plate two end walls 41, 42 are extending.

Said end walls are diverging from the base plate 40 forming angles a , b . The angles a , b are depicted as equal and can vary between 5 and 20 degrees,
10 preferably between 8 and 15 degrees. The illustrated embodiment shows an angle of divergence of 10 degrees for each end wall.

Symmetrically located with respect to said plate 40 is said hole 10a in an end wall 42.

Sidewalls 43, 44 extend between the end walls 41, 42 and are oriented in
15 parallel.

Said holes in said end walls, for instance the hole 10a in the end wall 42, are made circular, and the centre line 10a' referring to the hole 10a oriented at right angle to the plane 42' associated with the end wall 42.

One of the end walls, such as the end wall 42 has an upper surface 42a
20 and this surface serves as a support and a centre for an arcuate motion of the first part 51 when it is moved into co-operating with the second part 52.

An opposite end wall 41 is then adapted to receive the part belonging to the holder.

Referring to figures 8 - 11, these show an alternative embodiment for the
25 second part 52' belonging to the tool. In this embodiment, which in other respects coincides with what was described referring to figures 4 - 7, the side walls 43a', 44a' are extended upwards as shown in figure 8.

The side walls 43a', 44a' are extended past one end wall 42' to form two supporting surfaces 44b, 44c for the tool-holding part 51.

Figure 8 also shows that in addition to the support surface 42a and the
30 two support surfaces 44b, 44c there are further support surfaces 44d, 44e each belonging to a side wall 43a', 44a'.

The latter support surfaces 44d, 44e are made to extend upward and be located above the end walls.

Figure 2 illustrates in its enlarged part, that the support surface 44c is located to be able to contact one lug while the support surface 44e is shown in
5 contact with another lug further behind, and thereby the first part 51 is forcibly guided as it is moved towards co-operation with the second part 52.

Referring to figures 12 - 14, they show in sequence how the first part 51 belonging to the tool holder is moved into co-operation with the second part 52 belonging to the tool.

10 Figure 12 shows that the first claw-shaped projection 10 is to be inserted into the hole 10a while the first part 51 is tilted upwards with respect to the second part 52.

When the projection 10 is inserted, a guide part 51a, see detail figure 15, will contact and press against the support surface 42a.

15 The tip 10h of the projection 10 is forced to make an arcular motion along part of a circle 150, with the centre of the circle at the support surface 42a, while the claw is successively inserted farther into the hole 10a.

The rear portion 51' of the first part 51 then moves along a circular line
120.

20 Figure 13 shows a position when the rear portion 51' is about to contact the inner surface of the end wall 41 with high precision.

Figure 14 shows when the first part 51 is in a fully co-operating position with the second part, immediately before the projections 11, 12 are slidingly extended to co-operate with the holes 11a, 12a in order to lock the parts 51, 52 to-
25 gether.

It can be specially mentioned that the hole 10a could advantageously be provided with an inner wear protection, such as a wear ring 10a' of hard steel.

With reference to figure 5, it is explained that the V-shaped gullet 45 is formed by two diverging surfaces 45a, 45b which at the widest opening merge
30 into support surfaces 45c, 45d which are parallel to the bottom plate 40.

Said surfaces 45a, 45b, 45c, 45d are aimed to guide the first part 51 to an exact position relative to the part 52 by co-operation with corresponding surfaces on the part 51 positioned adjacent the position 51'.

5 More specifically, the claw 10 can be inserted in the hole 10a and the tool be lifted during the initial co-operation, and the first part 51 be later made to enter the second part 52 by a tilting motion of the piston and cylinder 7.

This invention is naturally not restricted to the embodiment described as an example above, but can be further modified within the frame of the invention concept as described in the following claims.

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PATENT CLAIMS

1. Tool coupling comprising a first part belonging to a tool holder and a second part belonging to a tool, where said parts are adapted to be easily made to co-operatively connect to each other, and easily be disconnected from each other, means being provided to bring the parts in one interlocked position and one unlocked position, and said first part being provided with at least one projection and said second part being provided with at least one hole, where the projection and the hole are in a co-operating position when the means have brought the parts to an interlocking position, **characterized** by said first part being provided with at least two projections, extending in opposite directions, and by said second part being provided with at least two holes, and by said projections being adapted for co-operating with said holes, and by at least one projection being adapted to be said means for interlocking the parts in a first position and unlocking the parts in a second position.
2. Tool coupling according to claim 1, **characterized** by one projection being rigid while the other is slidingly movable in a direction corresponding to the centre line of the projection.
3. Tool coupling according to claim 1 or 2, **characterized** by one projection among three being rigid and the slidable projections are designed for co-operation with one hole each in the same end wall.
4. Tool coupling according to claim 3, **characterized** by the rigid projection being located between the extended centre lines of the two slidable projections.
5. Tool coupling according to claim 4, **characterized** by the rigid projection being located in the same plane as the slidable projections.
6. Tool coupling according to claim 1, **characterized** by the second part being provided with a V-shaped gullet or corresponding, adapted for guiding the first

part until one or two projections are aligned with corresponding holes in the second part.

7. Tool coupling according to claim 6, **characterized** by the first part being
5 provided with a plug designed for co-operation with the V-shaped gullet.

8. Tool coupling according to claim 1, **characterized** by the single rigid projection being claw-shaped.

10 9. Tool coupling according to claim 8, **characterized** by said projection being diverging obliquely downward as well as diverging obliquely upward and tapering at least upward forward.

10. A part belonging to a tool, **characterized** by comprising two end walls
15 extending from a base plate or corresponding, where at least one end wall is diverging from the plate.

11. A part according to claim 10, **characterized** by each end wall diverging at an angle between 5 and 15 degrees, preferably about 10 degrees.

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12. A part according to claim 10 or 11, **characterized** by side walls extending between the end walls and having preferably parallel planes.

13. A part according to claim 10, **characterized** by having circular holes in
25 said end walls, each hole with a centre line at right angle to the plane of its corresponding end wall.

14. A part according to claim 10, **characterized** by one of said end walls having an upper edge serving as a supporting surface or centre for an arcuate
30 movement of a first part belonging to the tool holder.

15. A part according to claim 14, **characterized** by the opposite end wall being adapted for receiving with high precision a part belonging to the tool holder.

16. A part according to claim 12, **characterized** by the side walls being designed to extend past one end wall, to form support surfaces there for the part belonging to the tool holder.

17. A part according to claim 12, **characterized** by the side walls forming support surfaces between the end walls for the part belonging to the tool holder.

18. A part according to claim 17, **characterized** by said support surfaces being extended upwards and located above the end walls.

19. A part according to claim 13, **characterized** by one hole corresponding to a claw-shaped projection being provided with a wear resistant ring.

20. A part according to claim 15, **characterized** by said opposite end wall being provided with a V-shaped gullet.

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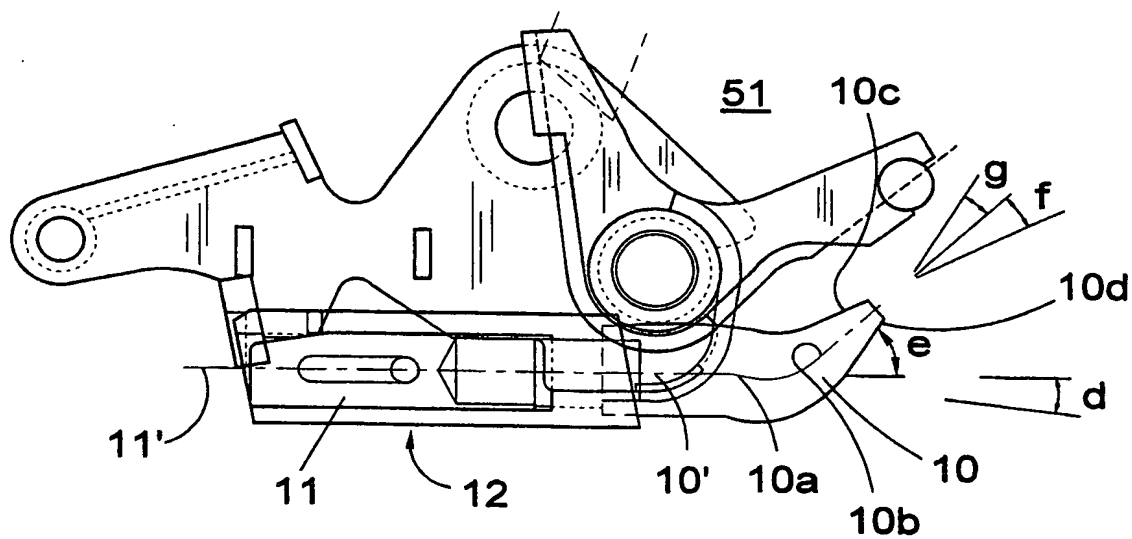
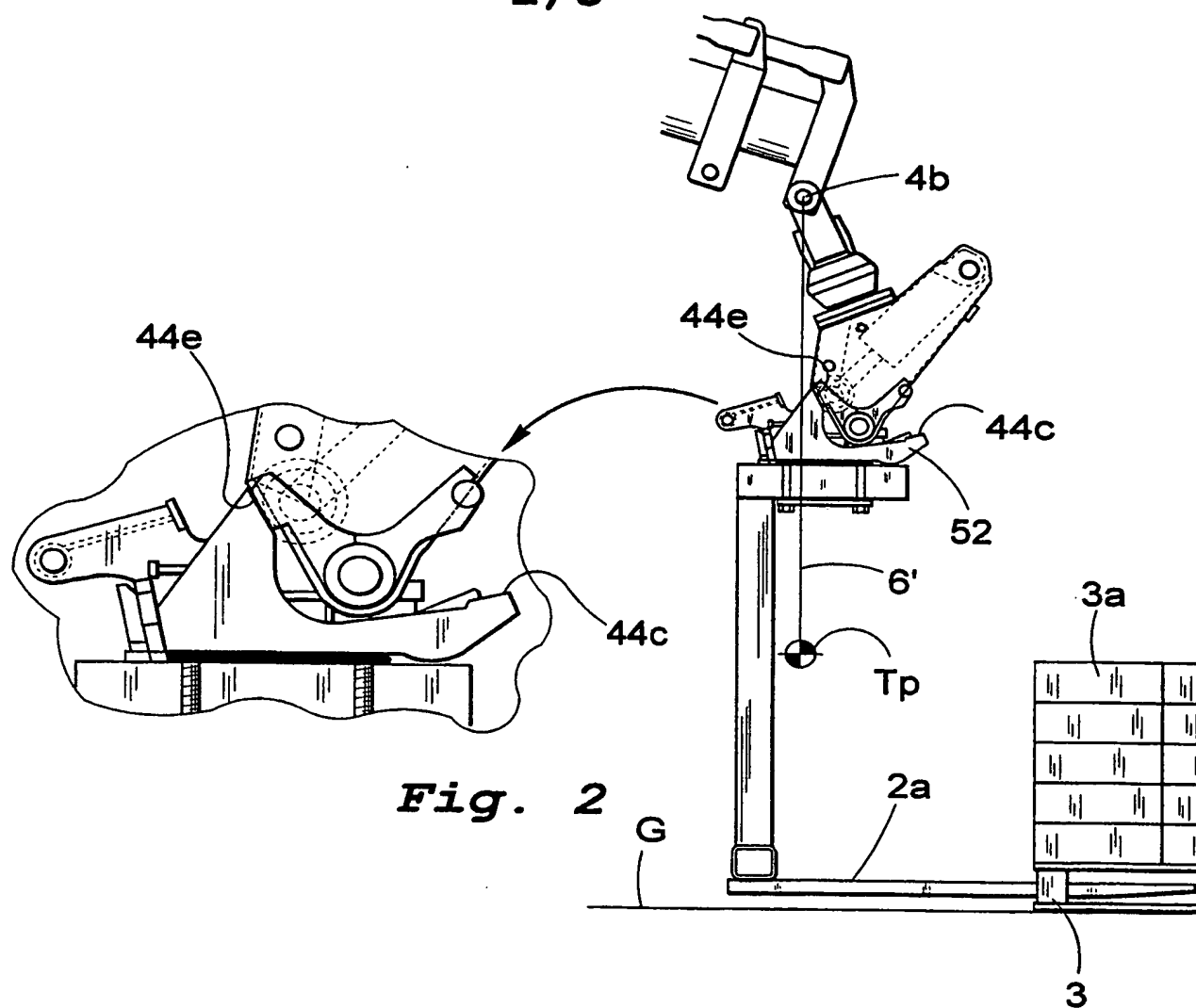


Fig. 3

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Fig. 4

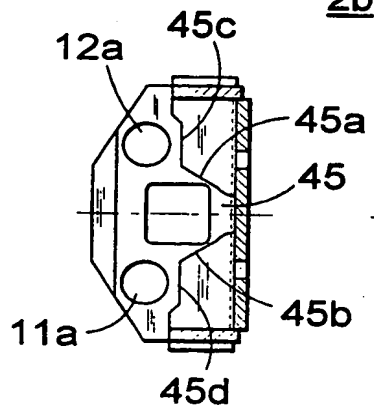
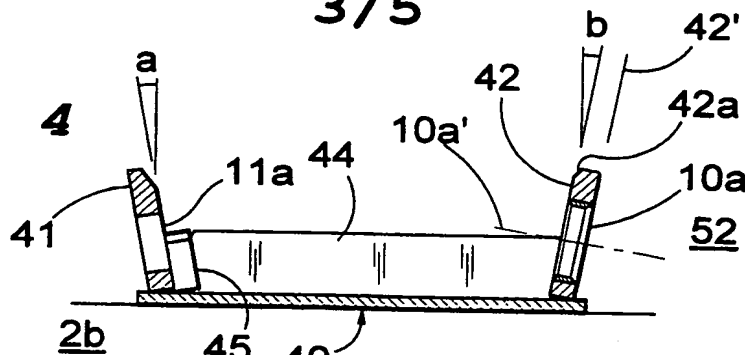


Fig. 5

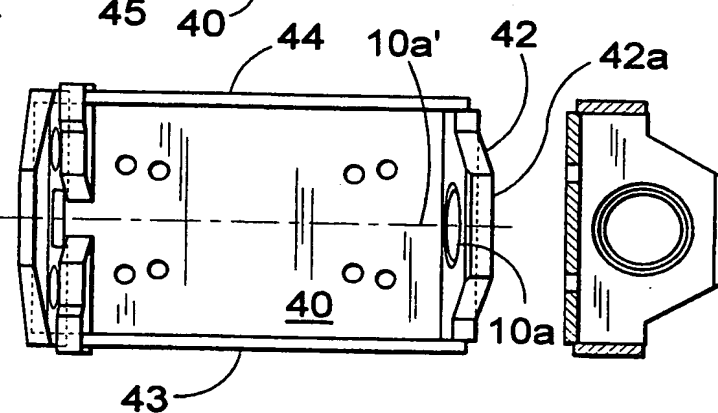


Fig. 6

Fig. 7

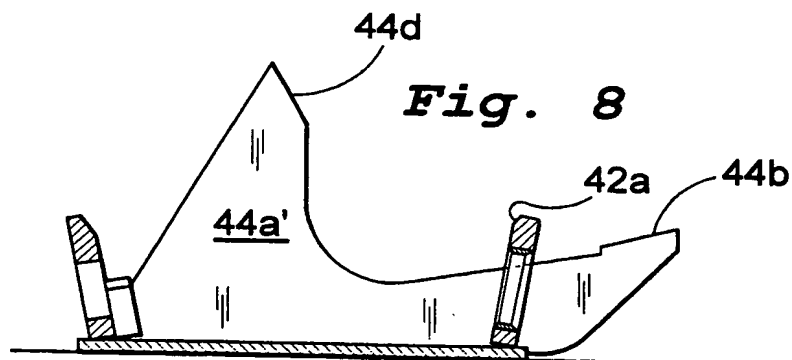


Fig. 8

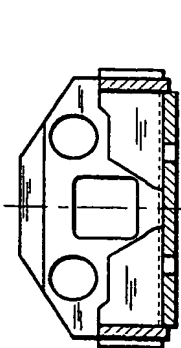


Fig. 9

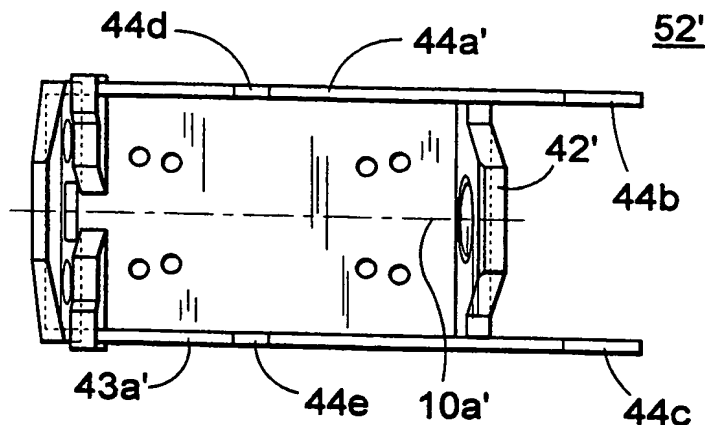


Fig. 10

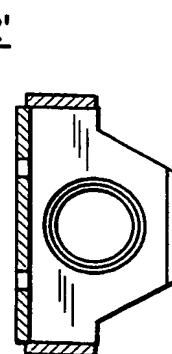


Fig. 11

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Fig. 12

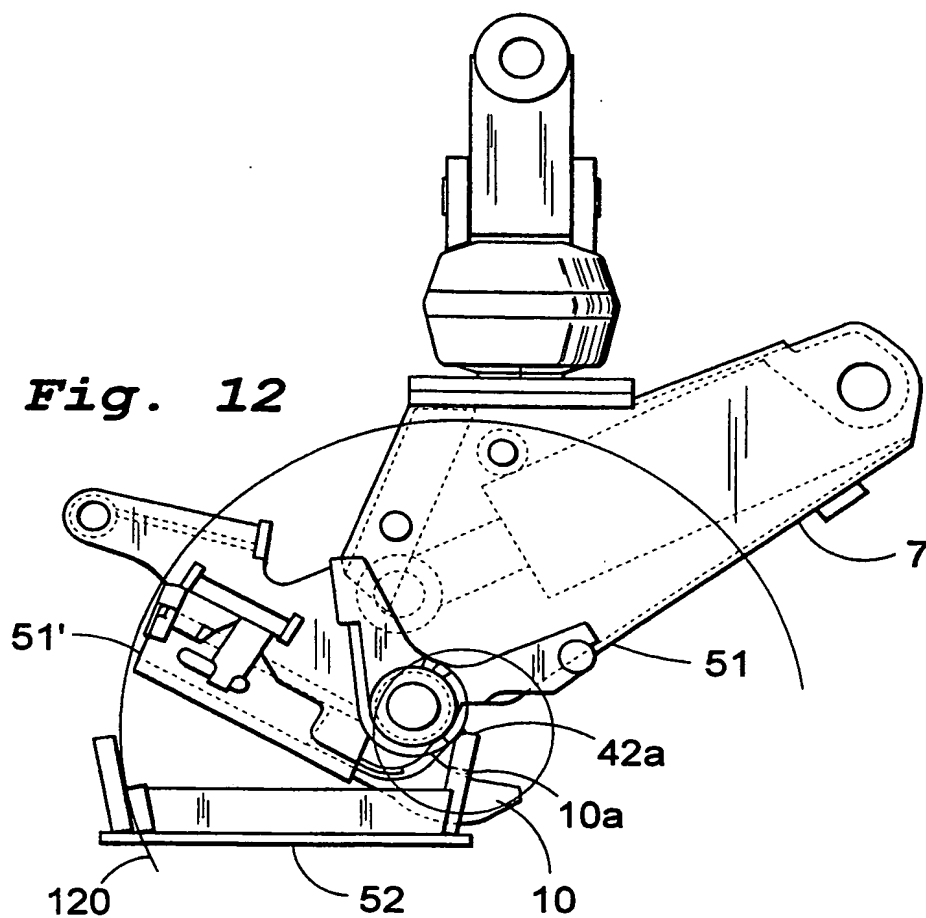
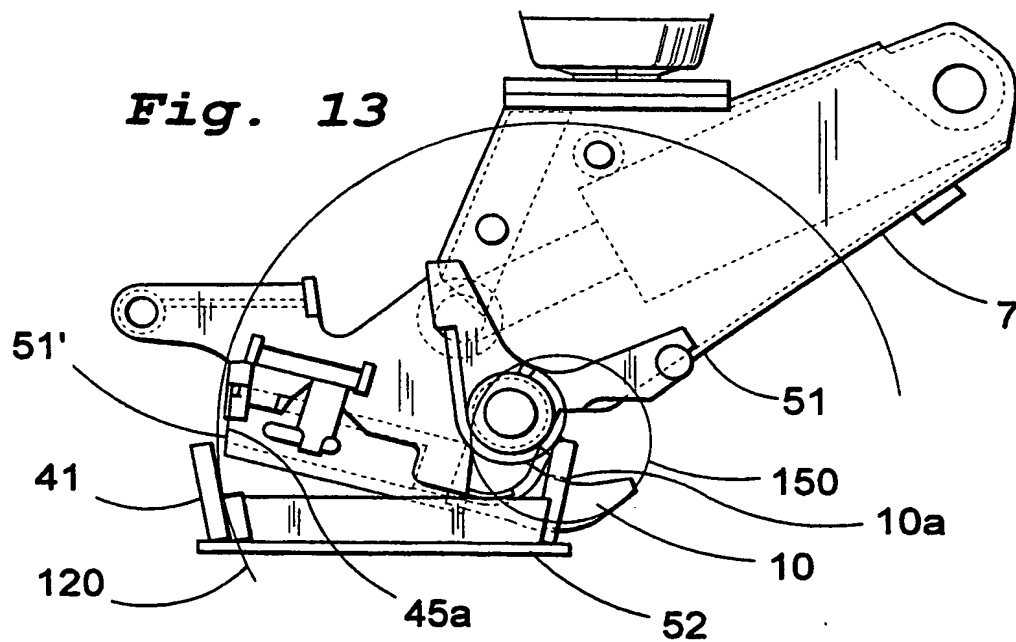


Fig. 13



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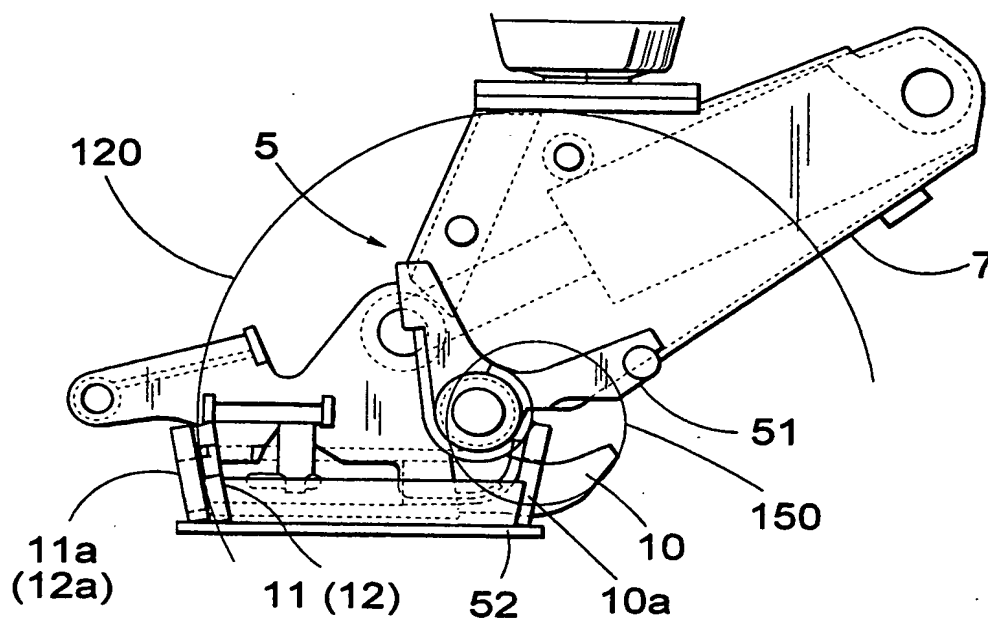


Fig. 14

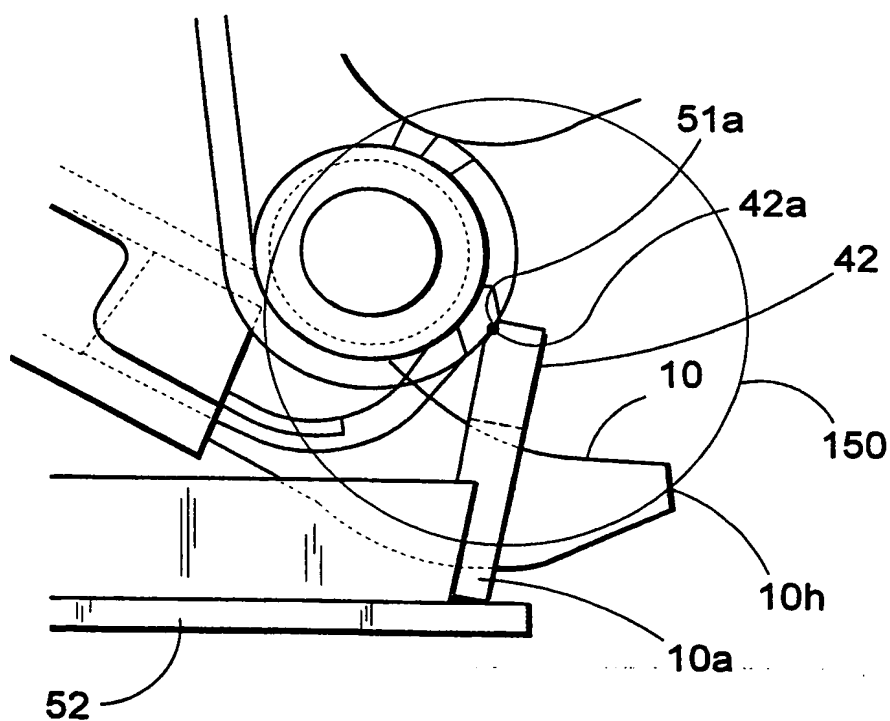


Fig. 15

SUBSTITUTE SHEET (RULE 26)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 99/02235

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: E02F 3/36 // B66C 13/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: E02F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, EPODOC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2259293 A (H.R. EDELEANU), 10 March 1993 (10.03.93)	1-5,8,9
A	--	6,7,10-20
X	US 5107610 A (N. FUSCO), 28 April 1992 (28.04.92)	1-5,8,9
A	--	6,7,10-20
X	US 5333695 A (K.-H. WALTER), 2 August 1994 (02.08.94)	1-5,8,9
A	--	6,7,10-20

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

1 March 2000

Date of mailing of the international search report

19-04-2000

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 99/02235

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	EP 0353454 A1 (V.T.N. BENNE S.R.L.), 7 February 1990 (07.02.90)	1-20
A	--	6,7,10-20
A	SE 467742 B (J.T. SONERUD), 7 Sept 1992 (07.09.92)	1-20
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Information on patent family members

02/12/99

International application No.

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SE 467742 B	07/09/92	AT 137550 T CA 2117095 A,C DE 69210405 D,T DK 602165 T EP 0602165 A,B SE 0602165 T3 ES 2088153 T FI 940873 A JP 2736286 B JP 6510343 T NO 179376 B,C NO 940720 A SE 9102566 A US 5465513 A WO 9305241 A	15/05/96 18/03/93 05/12/96 16/09/96 22/06/94 01/08/96 24/02/94 02/04/98 17/11/94 17/06/96 02/03/94 07/09/92 14/11/95 18/03/93